

## WHAT IS CLAIMED IS:

## 1. A composite sheet material comprising:

at least one porous core layer comprising at least one thermoplastic material and from about 20 weight percent to about 80 weight percent fibers based on a total weight of said porous core layer; and

at least one skin, each said skin covering at least a portion of a surface of said at least one porous core layer, said skin comprising at least one of a thermoplastic film, an elastomeric film, a metal foil, a thermosetting coating, an inorganic coating, a fiber based scrim, a non-woven fabric, and a woven fabric, said skin having a limiting oxygen index greater than about 22, as measured per ISO 4589.

2. A composite sheet material in accordance with Claim 2 wherein said thermoplastic film comprises at least one of poly(ether imide), poly(ether ketone), poly(ether-ether ketone), poly(phenylene sulfide), poly(arylene sulfone), poly(ether sulfone), poly(amide-imide), poly(1,4-phenylene), polycarbonate, nylon, and silicone.

3. A composite sheet material in accordance with Claim 1 wherein said fiber based scrim comprises at least one of glass fibers, aramid fibers, graphite fibers, carbon fibers, inorganic mineral fibers, metal fibers, metalized synthetic fibers, and metalized inorganic fibers.

4. A composite sheet material in accordance with Claim 3 wherein said fiber based scrim comprises at least one of polyacrylonitrile, p-aramid, m-aramid, poly(p-phenylene 2,6, benzobisoxazole), poly(ether-imide) and poly(phenylene sulfide).

5. A composite material in accordance with Claim 1 wherein said thermal setting coating comprises at least one of unsaturated polyurethanes, vinyl esters, phenolics and epoxies.

6. A composite material in accordance with Claim 1 wherein said inorganic coating comprises minerals containing cations selected from Ca, Mg, Ba, Si, Zn, Ti and Al.

7. A composite material in accordance with Claim 6 wherein said inorganic coating comprises at least one of gypsum, calcium carbonate and mortar.

8. A composite sheet material in accordance with Claim 1 comprising:

a first porous core layer having a first surface and a second surface; and

at least one skin covering at least a portion of at least one of said first and second surface.

9. A composite sheet material in accordance with Claim 1 comprising:

a first and a second porous core layer, each said core layer comprising a first and a second surface, said second surface of said first core layer positioned adjacent said first surface of said second core layer; and

at least one skin covering at least a portion of at least one of said first and second surfaces of said first core layer and said first and second surface of said second core layer.

10. A composite sheet material in accordance with Claim 9 wherein said first porous core layer comprises at least one of a different thermoplastic material and a different fiber than said second porous core layer.

11. A composite sheet material in accordance with Claim 1 comprising:

a first, a second, and a third porous core layer, each said core layer comprising a first and a second surface, said second surface of said first core layer positioned adjacent said first surface of said second core layer, said second surface of

said second core layer positioned adjacent said first surface of said third core layer;  
and

at least one skin covering at least one of said first and second surfaces  
of said first core layer, said first and second surface of said second core layer, and said  
first and second surface of said third core layer.

12. A composite sheet material in accordance with Claim 11  
wherein one of said porous core layers comprises at least one of a different  
thermoplastic material and a different fiber than at least one of said other layers.

13. A method of manufacturing a porous fiber-reinforced  
thermoplastic sheet, said method comprising:

providing a porous fiber-reinforced thermoplastic sheet comprising at  
least one porous core layer comprising a thermoplastic material and from about 20  
weight percent to about 80 weight percent fibers; and

laminating at least one skin to a surface of the porous fiber-reinforced  
thermoplastic sheet, each skin comprising at least one of a thermoplastic film, an  
elastomeric film, a metal foil, a thermosetting coating, an inorganic coating, a fiber  
based scrim, a non-woven fabric, and a woven fabric, the skin having a limiting  
oxygen index greater than about 22, as measured per ISO 4589, to enhance at least one  
of the flame, smoke, heat release and gaseous emissions characteristics of the porous  
fiber-reinforced thermoplastic sheet.

14. A method in accordance with Claim 13 wherein the  
thermoplastic film comprises at least one of poly(ether imide), poly(ether ketone),  
poly(ether-ether ketone), poly(phenylene sulfide), poly(arylene sulfone), poly(ether  
sulfone), poly(amide-imide), poly(1,4-phenylene), polycarbonate, nylon, and silicone.

15. A method in accordance with Claim 13 wherein the fiber based  
scrim comprises at least one of glass fibers, aramid fibers, graphite fibers, carbon

fibers, inorganic mineral fibers, metal fibers, metalized synthetic fibers, and metalized inorganic fibers.

16. A method in accordance with Claim 15 wherein the fiber based scrim comprises at least one of polyacrylonitrile, p-aramid, m-aramid, poly(p-phenylene 2,6, benzobisoxazole), poly(ether-imide) and poly(phenylene sulfide).

17. A method in accordance with Claim 13 wherein the thermal setting coating comprises at least one of unsaturated polyurethanes, vinyl esters, phenolics and epoxies.

18. A method in accordance with Claim 13 wherein the inorganic coating comprises minerals containing cations selected from Ca, Mg, Ba, Si, Zn, Ti and Al.

19. A method in accordance with Claim 18 wherein the inorganic coating comprises at least one of gypsum, calcium carbonate and mortar

20. A method in accordance with Claim 13 wherein said providing a porous fiber reinforced thermoplastic sheet comprises providing a porous fiber reinforced thermoplastic sheet comprising a first porous core layer having a first surface and a second surface, and said laminating at least one skin comprises laminating at least one skin covering at least one of said first and second surface.

21. A method in accordance with Claim 13 wherein said providing a porous fiber reinforced thermoplastic sheet comprises providing a porous fiber reinforced thermoplastic sheet comprising a first and a second porous core layer, each core layer comprising a first and a second surface, the second surface of the first core layer positioned adjacent the first surface of the second core layer, and said laminating at least one skin comprises laminating at least one skin covering at least one of the first and second surfaces of the first core layer and the first and second surface of the second core layer.

22. A method in accordance with Claim 13 wherein said providing a porous fiber reinforced thermoplastic sheet comprises providing a porous fiber reinforced thermoplastic sheet comprising a first, a second, and a third porous core layer, each core layer comprising a first and a second surface, the second surface of the first core layer positioned adjacent the first surface of the second core layer, the second surface of the second core layer positioned adjacent the first surface of the third core layer, and said laminating at least one skin comprises laminating at least one skin covering at least one of the first and second surfaces of the first core layer, the first and second surface of the second core layer, and the first and second surface of the third core layer.

23. A method in accordance with Claim 13 wherein the skin comprise at least one of a fiber based scrim, a non-woven fabric and a woven fabric.

24. A composite sheet material comprising:

a permeable core comprising discontinuous fibers bonded together with a thermoplastic resin, said permeable core having a density from about 0.2 gm/cc to about 1.8 gm/cc, said permeable core including a surface region; and

an adherent layer adjacent to said surface region, said adherent layer comprising a material having a limiting oxygen index greater than about 22, as measured per ISO 4589.

25. A composite sheet material according to Claim 24 wherein said permeable core has an open cell structure.

26. A composite sheet material according to Claim 24 wherein said permeable core comprises at least one of metal fibers, metalized inorganic fibers, metalized synthetic fibers, glass fibers, graphite fibers, carbon fibers, ceramic fibers, and aramid fibers.

27. A composite sheet material according to Claim 24 wherein said permeable core comprises a thermoplastic resin selected from the group consisting of

polyethylene, polypropylene, polystyrene, acrylonitrilstyrene, butadiene, polyethyleneterephthalate, polybutyleneterephthalate, polybutyleneterachlorate, polyvinyl chloride, polyphenylene ether, polycarbonates, polyesterarbonates, thermoplastic polyesters, polyetherimides, acrylonitrile-butylacrylate-styrene polymers, amorphous nylon, polyarylene ether ketone, polyphenylene sulfide, polyaryl sulfone, polyether sulfone, poly(1,4 phenylene) compounds, silicones and mixtures thereof.

28. A composite sheet material according to Claim 24 wherein said core comprises from about 20 to about 80 percent by weight fibers and from about 20 to about 80 percent by weight of a thermoplastic resin.

29. A composite sheet material according to Claim 24 wherein said core comprises from about 35 to about 55 percent by weight fibers and from about 45 to about 65 percent by weight of a thermoplastic resin.

30. A composite sheet material according to Claim 24 wherein said composite has a four minute smoke density,  $D_s$ , of less than about 200 when tested in accordance with ASTM E662.

31. A composite sheet material according to Claim 26 having a thickness from about 0.5 mm to about 25 mm.

32. A composite sheet material according to Claim 26 wherein said adherent layer has a thickness from about 25 micrometers to about 2.5 mm.

33. A composite sheet material according to Claim 26 wherein said adherent adjacent layer comprises at least one of a thermoplastic film, an elastomeric film, a metal foil, a thermosetting coating, an inorganic coating, a fiber based scrim, a non-woven fabric, and a woven fabric, said skin having a limiting oxygen index greater than about 22, as measured per ISO 4589.

34. A composite sheet material in accordance with Claim 33 wherein said thermoplastic film comprises at least one of poly(ether imide), poly(ether

ketone), poly(ether-ether ketone), poly(phenylene sulfide), poly(arylene sulfone), poly(ether sulfone), poly(amide-imide), poly(1,4-phenylene), polycarbonate, nylon, and silicone.

35. A composite sheet material in accordance with Claim 33 wherein said fiber based scrim comprises at least one of glass fibers, aramid fibers, graphite fibers, carbon fibers, inorganic mineral fibers, metal fibers, metalized synthetic fibers, and metalized inorganic fibers.

36. A composite sheet material in accordance with Claim 33 wherein said fiber based scrim comprises at least one of polyacrylonitrile, p-aramid, m-aramid, poly(p-phenylene 2,6, benzobisoxazole), poly(ether-imide) and poly(phenylene sulfide).

37. A composite material in accordance with Claim 33 wherein said thermal setting coating comprises at least one of unsaturated polyurethanes, vinyl esters, phenolics and epoxies.

38. A composite material in accordance with Claim 33 wherein said inorganic coating comprises of minerals containing cations selected from Ca, Mg, Ba, Si, Zn, Ti and Al.

39. A composite material in accordance with Claim 38 wherein said inorganic coating comprises at least one of gypsum, calcium carbonate and mortar.